STUDY OF CLINICAL PRESENTATION AND EMERGENCY RETROGRADE DOUBLE PIGTAIL URETERIC STENTING FOR DRAINAGE IN CALCULOUS ANURIA

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CERTIFICATE

This is to certify that this dissertation entitled "**STUDY OF CLINICAL PRESENTATION AND EMERGENCY RETROGRADE DOUBLE PIGTAIL URETERIC STENTING FOR DRAINAGE IN CALCULOUS ANURIA"** submitted by **Dr. K. MURALIDHARAN**, appearing for **M.Ch (Urology)** degree examination in August 2007 is a bonafide record of work done by him under my guidance and supervision in partial fulfillment of requirement of the Tamil Nadu Dr. M.G.R. Medical University, Chennai. I Forward this to the Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India.

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CONTENTS

INTRODUCTION

Calculous anuria constitutes a urological emergency mandating prompt decompression of the collecting system. Anuria can result due to acute bilateral ureteral obstruction or an unilateral obstruction in a solitary functioning kidney due to urinary lithiasis. In the absence of relief of obstruction, this condition may be rapidly complicated by azotemia, uraemia, electrolyte disturbances, acidosis and extracellular fluid volume overload.

The optimum method of decompression of renal unit in calculous anuria remains controversial. The early modality for treatment of an obstructed kidney was limited to open nephrostomy. This procedure had high morbidity and mortality. The concept of percutaneous nephrostomy was attractive and the earliest of percutaneous nephrostomy was described by Goodwin and colleagues in 1955. The emergence of high – resolution ultrasonographic and improved fluoroscopic technique led to replacement of open nephrostomy by percutaneous procedure.

In 1877, Nitze devised a cystoscope in Germany, which made endoscopy of lower urinary tract feasible and more practical. One of the important factors in the technological revolution in urology was

introduction of fibre lighting and rodlens telescope by Sir Harold Hopkins. The invention developed due to the enterprise of Karl Storz, who was willing to invest a fortune to realize Hopkins dream, making endoscopy much more easy and exact.

The alternative to percutaneous nephrostomy was provided by passage of ureteric stents cystoscopically. Initially the stents were difficult in insert and migration of stent was frequent. The improvement in stent design, materials and development of guide wires provided an impetus to this procedure. The use of hydrophilic glide wires for access allowed negotiation past the difficult kinks and calculous obstruction. Percutaneous nephrostomy has been advocated with the belief that decompression is better due to wide bore of the tube. It also allows measurement of individual renal output and assessment of function. It avoids manipulation across the edematous obstructed ureter. Percutaneous nephrostomy tubes frequently get dislodged and patients in our set-up need to be admitted as they have difficulty in maintaining percutaneous nephrostomy tubes and have to travel to long distances in case of dislodgement. Retrograde ureteric stenting has benefits of internal diversion. The morbidity of the procedure is less and the patients can be discharged as soon as the general condition stabilizes and serum creatinine shows a downward trend. The patient can be subsequently

managed definitively. Stenting can be achieved in most of the cases of calculous anuria, if a technique with glidewire for access is adhered to.

This study deals with the clinical presentation of patients with calculous anuria; efficacy, feasibility and complications of decompression of obstructed renal unit in calculous anuria by use of retrograde double – pigtail stent.

AIMS & OBJECTIVES

1. To study the clinical presentation of calculous anuria
2. To assess feasibility and effectiveness of retrograde double – pigtail stenting in anuria.
3. To study outcome of these cases
4. To assess complication of double – pigtail stenting in cases of anuria

REVIEW OF LITERATURE

Anuria is cessation of urine flow. Obstruction to urine is a less common cause of acute renal failure and accounts for 10 – 20% of cases of acute renal failure (Schrier). Acute renal failure is defined as an acute deterioration in renal function resulting in build up of nitrogenous wastes in plasma and a failure of kidney to regulate extra cellular fluid volume and composition.

Calculous anuria is the commonest cause of obstructive anuria. Bennani and Debbagh conducted a study of obstructive anuria and reported aetiology of 60% cases due to calculi, 26.6% were due to pelvic malignancies and 13.4% due to retroperitioneal fibrosis. It is, however, an uncommon complication of calculous diseases. Anuria has been reported in 25 of cases of 767 patients studied by Joual in1997. In their study, 54% of cases were due to bilateral ureteral obstruction and 46% were due to unilateral obstruction. A study of calculous anuria in 18 children (Kheradpir MH), bilateral obstruction was seen in 14, unilateral obstruction with a non functioning kidney was seen in 3, aplasia in 1. Fifty percent of these patients had metabolic abnormality.

Ureteral and renal calculi both have similar composition and most renal calculi are those which have originated in renal pelvis. Certain anatomical characteristics of the ureter determine the site of impaction of calculi. The location of obstructing stones in the study groups was at the ureteropelvic junction in 23.8% patients, proximal ureter in 33.8% patients, 19% in middle ureter, and distal ureter in 52.4% (Margaret S. Pearle).

Patients with calculous anuria present with an anuria of sudden onset, which is preceded by a history of colic. Patients occasionally have a past history of renal surgery (Leong CH, Yu H, 1974), however, presenting symptoms may be varied (Chabbouri M, 1994).

Investigations in these patients reveal an elevated serum creatinine level. In a study by Hussain, serum creatinine was in the range of 3-35 mg%. Ultrasonography done in these patients shows different grades of hydronephrosis. However the elevation of serum creatinine and degree of hydronephrosis varies in patients and not proportional to the duration of obstruction. Ultrasonography done in a study by Pearle et al showed moderate degree of hydronephrosis in majority of cases. Non dilated and minimally dilated systems have also been seen (Vera Donoso, 1990).

Measurement of resistive index on Doppler has been mentioned to diagnose urinary obstruction (Campbell, 7th edn).

Approximately 90% of renal calculi are sufficiently radiopaque to be detected on abdominal radiography. In an adequately prepared bowel opaque calculi of 2-3 mm diameter can be detected by a plain radiograph. The overall sensitivity of radiograph in detecting a calculi is 90% (Thornbury JR, 1982). Confirming location of obstruction may require additional investigations like antegrade or retrograde pyelography. A Helical non enhanced CT has high success rate to demonstrate ureteral calculi in acute colic. Non – opaque calculi on conventional radiographs, appear as high on non enhanced CT (Sommer et al, 1995).

The use of DJ stent is now routine in urology, the main indications being benign and malignant strictures, obstructions due to stones, ureteric injury, prophylaxis following surgery and in acute hydronephrosis of pregnancy (Finney, 1978; Lang et al, 1979; Mardis et al, 1982; Ball et al, 1983; Jones et al 1983; Laversonet al 1984; Lang, 1984).

Self retaining ureteric catheter have developed from the use of endoscopically placed silicone rubber catheters, first described by Zimskind (1967) and Marmar (1970). These early stents had no drainage

holes, and did not provide adequate urinary drainage. The stents did not become commercially available until 1974. the first commercially available stent was the Gibbons. These purpose made stents were moulded with barbs and a flange at the lower end to prevent migration but these barbs made insertion difficult (Gibbons et al, 1976). Rutner and Fucilla 1976, reported improved insertion with catheters made of flexible tips. In 1978, Mardis developed a single pigtail configuration, which was effective in placement and reducing downward migration. However upward was effective in placement and reducing downward migration. However, upward migration was still a concern. Finney's Double – J designed was introduced in 1978. By curling both ends of the stent the upward and downward migration was reduced. A guidewire was utilized to straighten the stent for easier placement. The stent were further improved with the use of better biocompatible materials which were well tolerated, resist encrustation and can be kept in situ for a longer time obviating the need for frequent stent change. Silicone is the standard by which other materials are measured for tissue compatibility. Silicone is soft and non – irritating and resistant to encrustation making them desirable for long – term use. However, due to its softness silicone has higher coefficient of friction than other stent materials. Thermoplastic elastomers include polyurethane and variety of other materials like C - Flex, Puro – Flex and silitek. In addition, due to varying degrees of

stiffness stents made from these materials have thinner walls than silicone stents, permitting a greater flow rate through the larger the larger lumen. The rigidity of these materials also facilitates easier passage through the guide wire.

Margaret S. Pearle, H. Lyle Pierce and colleagues in 1998 published their report on optimum method of urgent decompression for obstruction and infection due to ureteral calculi. Forty two cases of obstructing ureteral calculi and clinical signs of infection were randomized (temperature greater than 38 C and / or white blood cell count of 17000 / mm^3) to drainage by percutaneous nephrostomy or retrograde ureteral cathterisation. A white blood cell count of 17000 / mm3 was arbitrarily chosen as a cut-off as patients with obstructing stones often present with mild leucocytosis. Pre-operative patient and stone characteristics, procedural parameters, clinical outcomes and costs were assessed in two groups. The location of obstructing stones in the study groups was at the ureteropelvic junction in 23.8% patients, proximal ureter in 33.8% patients, 19% in middle ureter, and distal ureter in 52.4% Retrograde catheterization was done in 62% in general anaesthesia, in 14% regional anaesthesia and in 24% intravenous sedation. Percutaneous nephrostomy was done in local anaesthesia supplemented with intra-venous sedation. Procedural and fluoroscopy

times were significantly shorter in the retrograde stent group. (32.7 and 5.1 minutes) compared with the percutaneous nephrostomy group (49.2 and 7.7 minutes respectively). One treatment failure occurred in percutaneous nephrostomy group, which was salvaged by retrograde catheterization. Time to normal temperature was 2.3 days in the percutaneous nephrostomy group and 2.6 days in stented group. Time to normal white blood count was also statistically not significant in the two groups. Length of stay was 4.5 days in the percutaneous nephrostomy group, compared with 3.2 days in the stent group (p not significant). They concluded that stent and percutaneous nephrostomy effectively relieve obstruction and infection due to ureteral calculi. Neither modality demonstrated superiority in promoting a more rapid recovery after drainage. Stenting was shorter to perform than percutaneous nephrostomy. Less minutes of fluoroscopy time was required for stenting than percutaneous nephrostomy. The more frequent use of general anaesthetic for retrograde stent was problematic in their study and accounted for greater cost in the stent group. They also cited advantages stent in patients required ESWL and ureteroscopy.

Percutaneous nephrostomy was associated with a greater morbidity Lee et al reviewed their experience 160 patients (169) procedures. Major complications included in 6% including sepsis in patients not previously

septic and haemorrhage requiring transfusion in 2.4% Minor complications occurred in 27.7% of patients, included catheter dislodgement

Andriole and Bettman (1984) reported their use of DJ stents in 87 patients. The majority of patients were placed under local anaesthesia (54%). 136 stents were used in 87 patients. There were 24 identifiable complications owing either to stent or its placement. More than half of the complications were due to stent obstruction. They concluded that obstruction increased with length of time the stent was used and was not related to stent size.

Stones in the upper ureter can be managed by ESWL both after upward displacement and in their original location. Having a stent adjacent to the stone enhances fragmentation and clearance as stent creates a fluid interface around the stone (Coptcoat MJ, 1985). Shock wave localization is also simplified with the radiopaque marker in place (The Urol Clinics N. America, 1990). No statistical significant difference has been identified in the ability of ESWL to fragment stones pushed back to renal pelvis versus those that were simply by passed with a stent (Leong. 1986). In both cases the results are significantly better than those obtained with the stones in situ. In situ ESWL is claimed to have success

in 95% stone free rate proximal ureteral calculi by Chaussy and Schmiet. However other authors report only 62% success rate (Muller SC, 1986) and 28% of patients with stones treated in situ at Methodist hospital in Indiana required multiple sittings or additional procedures (Lingeman JE, 1986).

In 1980, Perez – Castro and Martinez – Piniero described placing a ureteral catheter 24 – 48 hours prior to planned ureteroscopic procedure as a method of subacute or passive dilatation of ureter. An internal stent before ureteroscopy facilitates the procedure and is an additional advantage in such patients.

PATHOPHYSIOLOGY OF UPPER URINARY TRACT OBSTRUCTION

Urinary obstruction with resultant hydronephrosis adversely affects renal functions. The postulated mechanisms of renal damage are mainly due to elevated ureteral pressure, decreased renal blood flow which causes cellular necrosis and atrophy.

PATHOLOGICAL CHANGES

Pathological changes occurring in the kidney, pelvis and ureters have been studied after complete obstruction. Gross appearances show a progressive dilatation of the pelvis during the first few weeks but little damages to the collecting system. 4-8 weeks of obstruction causes the obstructed kidney to appear blue with areas of ischaemia, wedges of congestion, necrosis and infarcts. The size of the kidney is determined by the length and degree of obstruction and presence of an intra – renal or extra – renal collecting system (Talner, 1990). A further length of time causes the collecting system to enlarge until there are thin septae between the calyces and with the thin rim of parenchyma peripherally. Early changes in the ureters show a proximal dilatation with muscular hypertrophy and hyperplasia occurring in the ureter proximal to the obstruction. The was followed by the progressive dilatation and increased tortuosity of the ureters.

Microscopic changes in progressive hydronephrosis have been demonstrated in dogs (Hinman, 1925). Similar studies in another animal models showed similar results. These animal models form the basis of understanding of the pathophysiology of obstruction in humans. It has

been found that the pathological changes in a completely obstructed kidney correlate well with the observed physiological changes.

PHYSIOLOGICAL CHANGES

Physiological changes occur in an obstructed kidney. These changes are dependent on the site, degree and rapidity of onset of obstruction.

The physiological changes further vary in unilateral and bilateral obstruction and the kidney shows further damage with infection. It is found that bilateral ureteral obstruction is followed by a rapid increase in the ureteral pressure in the first four and half hours to stop flow levels. The actual pressure reached is conditioned by the hemodynamic response to obstruction and may reach 70-80 mm Hg. This ureteral pressure then remains elevated upto 24-48 hours (Gulmi et al, 1995).

The hemodynamic changes noted in bilateral ureteral obstruction are an initial rise in the renal blood flow in the first 90 minutes (Moody et al, 1977). Which is probably due to a prostoglandin mediated and afferent arteriolar dilatation. This is followed by a significant decrease below normal for upto 7 hours, which is due to poorly understood mechanism.

Thus the haemodynamic changes in the bilateral ureteral obstruction show an initial preglomerular vasodilatation and then a postglomerular vasoconstriction. The decrease in the renal blood flow is associated with an increased renal vascular resistance. The renal blood flow is distributed such that 55% of the renal blood flow is to cortical nephrons and 14% to the innermost renal zones (Jaenike, 1972). Thus, by 24 hours the renal blood flow is low and renal vascular resistance is high. Studies show that glomerular filtration is also significantly reduced after 48 hours of obstruction (Gulmi et al, 1995). However the number of functioning nephrons and their glomerular filtration rate is higher with 84% of superficial and 49% of juxtameduliary nephrons functioning after 24 hours of bilateral ureteric obstruction (Yarger and Harris, 1985). Tubular changes markedly impair the ability to conserve sodium and water and acidify the urine. The tubular changes are due to structural damage to inner medulla and papillae with a loss of medullary hypertonicity and insensitivity of the tubules (Wilson and Klahr, 1993).

Bilateral ureteral obstruction is associated with retention of urea and solutes and an increase in serum ANP which is due to direct effect of obstruction on the tubules (Mc Dougal and Wright, 1972; Jaenicke, 1972). Relief of bilateral arterial obstruction is associated with a unique phenomenon of post obstructive diuresis. It is characterized by marked

polyuria and natriuresis. The diuresis may be physiological caused by retained urea, sodium and water or pathological due to loss of concentrating ability or sodium resorption (Earley, 1956; Loo and Vaughan. 1985). Patients most likely to exhibit this are patients with oedema, CCF, hypertension, weight gain, azothemia and uremic encephalopathy. Fortunately, most patients do not exhibit post obstructive diuresis and those who do, have limited period of physiological diuresis with rapid return of blood urea and serum creatinine to normal levels within 24-48 hours.

Relief of obstruction is associated with a recovery of renal function. There is improvement in glomerular filtration rate, renal blood flow, concentrating ability (Berlyne, 1961; Earley, 1956), and acidification (Berlyne, 1961) after relief of bilateral ureteral obstruction. The recovery potential is dependent on severity of renal injury and presence and absence of infection. Human studies show a two phase improvement in renal function, an initial or tubular phase during the first two weeks and a later glomerular phase occurring between 2 weeks to 3 months.

MATERIALS AND METHODS

All cases of calculous anuria presenting to our department from November 2004 to February 2007 were included in this prospective study. Patients were studied as per clinical presentation, biochemical and radiological investigations. An attempt of decompression was done with passage of DJ stent bilaterally or unilaterally in case of solitary functioning kidney. The exclusion criteria were patients with urethral stricture, pregnancy, urinary diversion and clinical diagnosis of pyonephrosis. The failed attempts of stenting were salvaged by passage of percutaneous nephrostomy tube. These patients were excluded from further study.

These patients were managed according to a protocol and study was recorded in proforma as follows:

Patient data:

Name : Age: Sex

In patient Number:

Date of admission:

Date of discharge:

Ward No.:

Presenting complaints:

Duration:

History of presenting illness:

Past history:

Family history:

Personal history:

Gynaecological and obstetric history in females:

General symptoms:

Fever chills	Vomiting	Headache
Dizziness	Weakness	Anorexia
Weight loss	Oedema	Bowel dysfunction

Other symptoms:

General examination:

General condition	Pulse	Temperature
Respiration	BP	Height
Weight	Build	Pallor
Oedema	Neck	Throat
Conjunctiva	Icterus	

Abdominal examination:

Genital examination:

Local examination:

Per rectal examination:

CNS :

CVS:

RS:

Skeletal examination:

Diagnostic impression:

Record time / date:

Biochemical examination:

1. Haemogram, BT, CT, PT
2. RFT
3. Serum electrolytes
4. Arterial blood gas analysis

Radiological examination:

1. Radiograph of KUB region:
2. USG of KUB region:

Perurethral catheterization done (applicable in all patients)

Surgical interventions:

Anaesthesia : Local

Sedation supplemented YES / NO

Cystoscopy:

RGP :

Unilateral / Bilateral DJ stenting:

Salvage procedures : PCN done: - YES / NO

Complications:

1. Intra operative :

2. Post operative:

Nephrological management:

Dialysis : YES / NO

Post operative questionnaire to assess intraoperative discomfort (tick mark whichever is applicable)

Mild	Moderate	Severe

Post operative recovery of patients (not applicable to patients with salvage procedure & on dialysis therapy).

Postoperative recovery:

Catheter removed after 48 / 72 hours:

Date :

Examination finding:

1.	Date
2.	Urine output
3.	Electrolytes
4.	Sr. Creatinine

Antibiotic therapy:

Hospital stay :

Further evaluation:

1. Biochemical investigation
2. Urine culture
3. Radiological investigation
    1. Xray KUB
    2. USG
    3. Radionuclide scanning
    4. IVU

Definitive treatment:

1. ESWL
2. PCNL
3. URS
4. Antegrade URS
5. Open surgery

Final outcome of patients:

Serum creatinine on completion of treatment:

Follow up :

PROCEDURE OF RETROGRADE STENTING

All patients presenting with anuria were diagnosed as due to calculus disease on the basis of history, clinical examination, plain radiograph and Ultrasonography of KUB region. Patient and relatives were explained about the following surgical intervention and informed consent was taken. All patients received a pre op broad spectrum antibiotic like Cefotaxim or Cefoperazone according to their serum creatinine level. The procedure was performed under local anaestesia with intravenous supplementation if required. The length of the stent required to be used in a patient was determined on retrograde pyelography film. An approximate length of stent can also be judged on X- ray KUB by measuring the length from transverse process of L2 vertebra to ischial spine and by adding one centimeter for right kidney and 2 centimeters for left kidney. Patient was put in lithotomy position. Cleaning and draping was done. 20 cc of lignocaine jelly was introduced into the urethra with 20 cc syringe capped with a Foleys adapter. The penis was clamped with a soft penile clamp for 10 minutes. In female patients 5 cc of jelly was introduced into the urethra. An anaesthetist was kept standby to give sedation if patients experienced discomfort. Cystourethroscopy was done using a 30 degrees forward / lens with a 21 Fr sheath. Ureteric orifice was located. A 0.035 - inch, 145 cm Terrumo

plastic coated hydrophilic glide wire supported in a 6 Fr open ended Ureteric catheter and the whole assembly was passed through the catheterization bridge. The Ureteric catheter was brought upto the ureteric orifice and the orifice engaged gently. The level of obstruction, ascertained by the x-ray KUBU was kept in mind, while passing the Glidewire. When there was difficulty usually at the level of obstruction, the glide wire was manipulated gently. When the glide wire was passed, the ureteric catheter was gently passed over the glidewire. The markings over the ureteric catheter were carefully noted while advancing the catheter. Then the glide wire was taken out and the contrast was injected slowly and was terminated when the patient complained of fullness / Flank pain. After, AP exposure was taken immediately with the patient supine.

When the renal collecting system was visualized, Ureterogram was performed. The 0.035 inch guide wire was passed into the Ureteric catheter and the catheter was slowly withdrawn. (withdrawal Ureterogram). A film was taken immediately as the catheter was withdrawn from the ureteric orifice.

Then open ended 6F double pigtail stent was gently passed over the guidewire, behind which the pusher was passed. The markings over the

stent were carefully watched, and when the predetermined length as ascertained by KUB and previous RGP films has been pushed inwards the guide wire was withdrawn while simultaneously pushing the pusher gently. Finally correct positioning of double pigtail stent was ascertained.

Same procedure was repeated in the opposite side (Except in the solitary kidney)

The total operation time was recorded. Per urethral Foley catheter (16F) was put 48-72 hrs post operatively. A radiograph of KUB region was repeated at a convenient time after the procedure to record the stent position.

OBSERVATIONS

This is a prospective study of all patients of calculus anuria who presented in our department from Nov 2004 to Feb 2007. All patients of anuria were examined on history and physical examination. All patients underwent Ultrasonography and radiograph of KUB region. Thirty two patients were diagnosed as cases of calculus anuria. Three renal units could not be stented due to technical failures and hence were not included in this study. One patient was rejected as the patient was a case of urethral stricture, which did not allow 14 Fr Calibrating catheter and hence percutaneous nephrostomy under sonographic guidance was done in this patient. Three patients had severe electrolyte disturbances, acidosis and had to be promptly shifted to Nephrological unit for treatment. Dialysis was done in these patients in emergency and these patients had to be excluded from study. Thus, this study comprises of 25 patients of calculous anuria.

Table 1 : Distribution of cases of calculus anuria:

Calculus anuria diagnosed	**32 cases**
Failure to stent	**3**
Rejection criteria (urethral stricture, prior dialysis)	**4**
Total cases in further study	**25**

Failure to stent in 2 patients was due to inability to visualize a ureteric orifice in the third case the glidewire could not be negotiated across the obstruction. This attempt led to perforation of ureter and percutaneous nephrostomy was done.

Patient showed variable duration of anuria ranging from two days to five days with maximum number of patients presenting after 72 hours.

Table 2 : Duration of anuria

Duration	Number of cases (percentage)
0-24 hours	**0 (0%)**
1-2 days	**3 (12%)**
2-3 days	**8 (32%)**
3-4 days	**12 (48%)**
4-5 days	**2 (8%)**
Total Number of cases	**25**

Mean duration: 3.2 days

The age of the patients range from 16 years to 55 years with maximum number of patients presenting between 31 to 40 years of life with a mean age of presentation. We did not encounter any case of paediatric age group in our study.

Table 3 : Age distribution of patients of calculous anuria:

Age group	Number of Patients (percentage)
11-20	**3 (12%)**
21-30	**3 (12%)**
31-40	**11(44%)**
41-50	**5 (20%)**
51-60	**3 (12%)**

Mean age : 35.64 yrs.

The patients with calculous anuria were predominantly males with male female ratio of 3.2:1. There were 19 males and 6 female patients in this study.

Table 4 : Sex distribution

Sex	Cases	Percentage
Male	**19**	**76**
Female	**6**	**24**

Four patients in our study had solitary functioning kidney. Bilateral ureteric obstruction was seen in 21 patients.

Table 5 : Kidney involvement in calculus anuria:

Kidney Involvement	Cases	Percentage
Bilateral	21	84
Unilateral	4	16

Table 6 : Causes of solitary kidney

Previous nephrectomy	2
Congenital absent kidney	1
Non functioning opposite kidney	1

Clinical presentation:

Anuria was the criteria of inclusion in this study. All patients who presented with anuria and diagnosed as cases of calculous anuria were included in this study. Flank pain was the second commonest symptom.

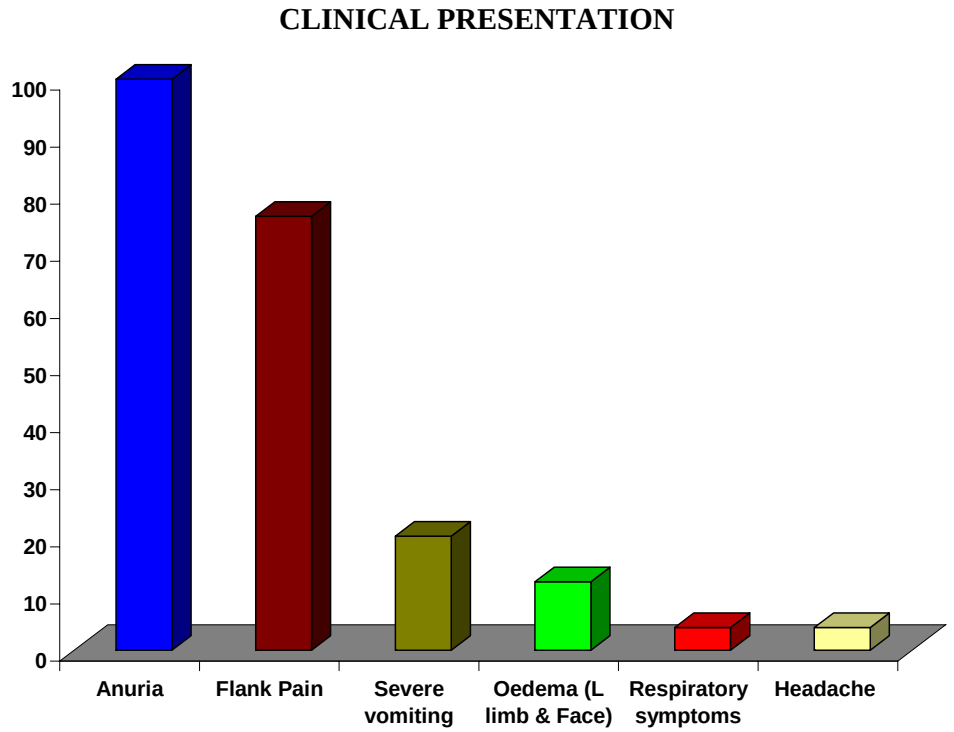
Table 7 : Flank pain presentation:

Flank Pain	Number of cases	Percentage
Bilateral	**13**	**68**
Unilateral	**6**	**32**

Total cases 19

Table 8 : Clinical presentation of patients in the study

Presentation	Number of cases	Percentage
Anuria	**25**	**100**
Flank pain	**19**	**76**
Severe vomiting	**5**	**20**
Oedema (L limb & face)	**3**	**12**
Respiratory symptoms	**1**	**4**
Headache	**1**	**4**



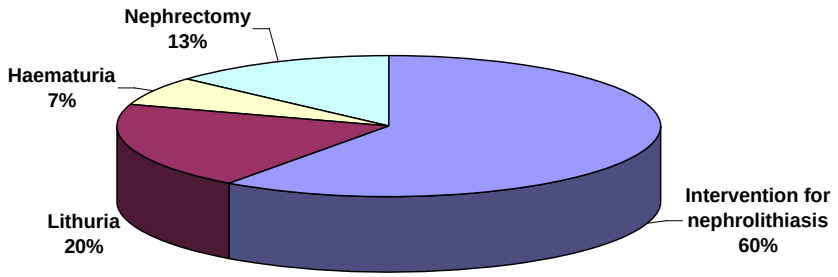
19 patients (76%) had history of flank pain on presentation. Of these 4 patients had history of loin to groin pain of sudden onset which was radiating and preceded anuria. Unilateral pain was seen in 6 patients. 13 patients had bilateral flank pain. Severe vomiting, oedema over lower limbs and head ache were also presenting features. One patient had breathlessness as a result of acidosis. Patients with fever, leukocytosis or clinical findings suggestive of pyonephrosis were not included in this study.

Fourteen Patients (56%) has prior urological history.

Table 9: Significant Past History

Intervention for nephrolithiasis	**9**
Lithuria	**3**
Haematuria	**1**
Nephrectomy	**2**

SIGNIFICANT PAST HISTORY



Prior intervention for nephrolithiasis was done in 9 patients, Who underwent endoscopic and open procedures for removal of calculi. Other significant history included history of lithuria and haematuria. Nephrectomy was done in a patient for pyonephrosis secondary to calculus disease and for a poorly functioning kidney with multiple calculi in other patient.

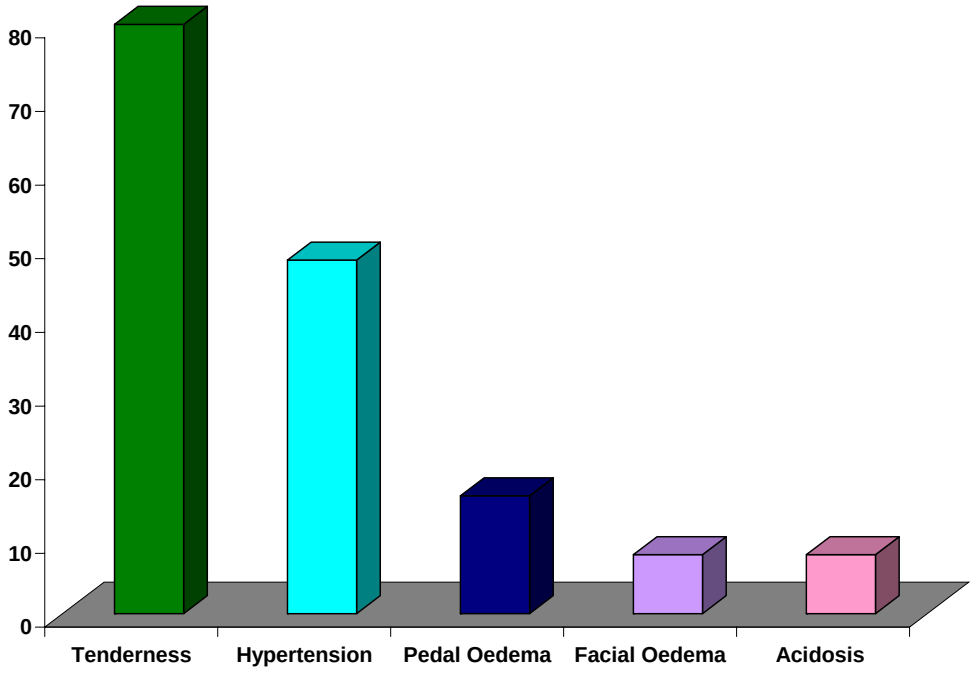
EXAMINATION FINDINGS:

Flank tenderness was present in twenty patients. 12 patients had bilateral tenderness and 4 patients had unilateral tenderness. Hypertension was seem in 10 patients with range of diastolic blood pressure between 90 – 110 mm Hg. Facial oedema was present in 2 cases and pedal oedema was clinically elicitable in 4 patients, 2 patients had acidosis.

Table 10 : Examination Findings

Findings	Number of patients	Percentage
1. Tenderness	**20**	**80**
2. Hypertension	**12**	**48**
3. Pedal oedema	**4**	**16**
4. Facial oedema	**2**	**8**
5. Acidosis	**2**	**8**

EXAMINATION FINDINGS



LABORATORY INVESTIGATION:

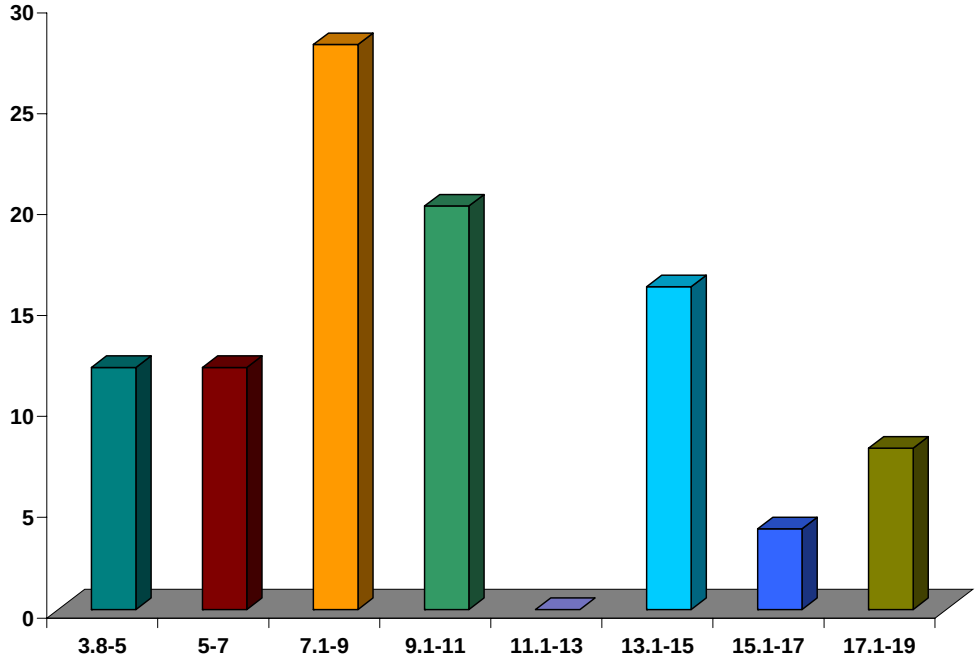
Renal function tests, arterial blood gas analysis was done on admission. Renal function tests were repeated after 24 hours of stenting. If downward trend of creatinine was seen after 24 hours a repeat creatinine was done after 72 hrs. Electrolyte measurement was done daily.

The serum creatinine levels ranged from 3.8 mg% to 18mg%. The mean value of creatinine was 9.16 mg%.

Table 11 : Serum Creatinine levels

Serum creatinine range	Number of patients	Percentage
3.8 – 5	3	12
5-7	3	12
7.1 -9	7	28
9.1 -11	5	20
11.1-13	0	0
13.1-15	4	16
15.1-17	1	4
17.1-19	2	8

SERUM CREATININE LEVELS



Patient in metabolic acidosis required frequent arterial blood gas analysis and management of these patients was done with the

co-operation of nephrologists. One patient in study group required such management after stenting.

Mild leukocytosis was a common finding with total leucocytes count ranging from 10000-15000/ cubic mm in 15 patients. 2 patients showed a count of more than 15000/ cubic mm but since clinical diagnosis of pyonephrosis was not made in these patients on the basis of clinical history and physical examination, they were included in study group. None of the patients had elevated blood sugar in our study. Coagulation profile was deranged in 3 patients of study group. However this was not serious enough to mandate treatment and retrograde stenting was successfully done these patients.

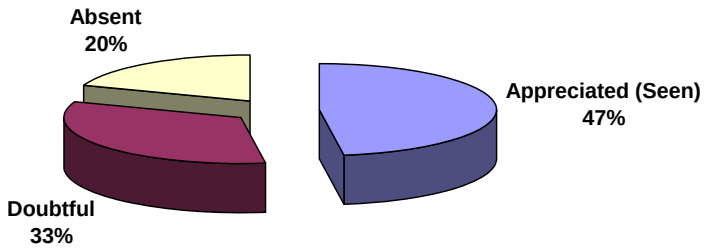
RADIOLOGICAL INVESETIGATIONS:

A radiograph and Ultrasonography of KUB region was done in all patients. Radiograph done in this setting has less than optimum preparation. A radiopaque density was seen clearly in 22 kidneys and ureters, 15 patients had a doubtful radiopaque density in kidney and ureter region while on 9 sides no radiopaque density was seen.

Table 12 : Plain radiograph's findings

Radio opaque density	Number of renal units / ureters
Appreciated (Seen)	**22**
Doubtful	**15**
Absent	**09**
Total	**46**

PLAIN RADIOGRAPH'S FINDINGS



Plain radiograph showed a calculus 47.82% of cases. 32.60% of cases clinical correlation was required for a doubtful radiopaque density.

Ultrasonography findings for hydronephrosis were divided as minimal, moderate and gross hydronephrosis. Minimal hydronephrosis was mild fullness of pelvicalyceal system with mild splitting of echogenic sinus. Moderate hydronephrosis was defined as a well – defined anechoic area with a echogenic rim surrounding it with a renal parenchyma that appeared normal. Severe hydronephrosis was diagnosed by a marked

dilatation and distortion of collecting system with a thin rim of renal parenchyma.

Minimal hydronephrosis was seen in 34 of the 46 kidneys studied. Moderate hydronephrosis was diagnosed in 8 kidneys. The remaining 5 kidneys showed gross hydronephrosis.

Table 13 : Ultrasonography findings in calculous anuria

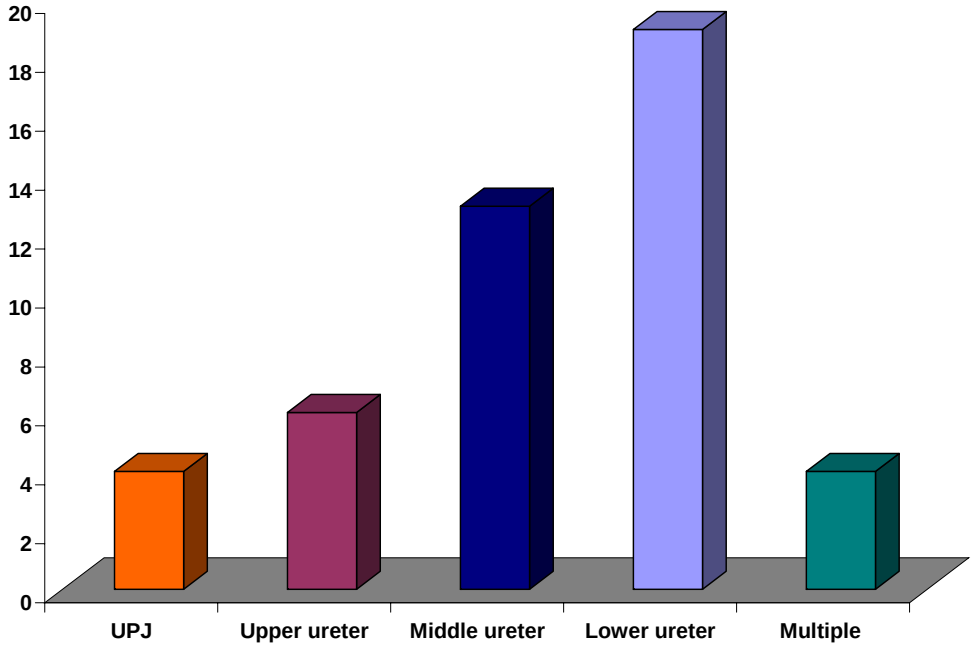
Hydronephrosis	**Number of kidneys**	**Percentage**
Minimum	**32**	**69.56**
Moderate	**10**	**21.73**
Severe	**4**	**8.69**

Retrograde pyelography prior to stenting was helpful in confirmation of obstruction and was a useful adjuvant to plain radiograph and Ultrasonography. Lower ureter and middle ureter was frequent site of obstruction.

Table 15 : Site of obstruction on radiograph of KUB and RGP

Site of calculus	Number of sides
UPJ	**04**
Upper ureter	**06**
Middle ureter	**13**
Lower ureter	**19**
Multiple	**04**

SITE OF OBSTRUCTION



ANAESTHESIA REQUIREMENTS:

All procedures were done under local anaesthesia. Ten patients (40%) required intravenous sedation in supplementation. Almost all male patients described their discomfort as moderate on the scale of mild, moderate or severe.

OPERATIVE TIME:

Total operative time was measured from cystoscopy to the completion of procedure. Minimum time required for a procedure was 22 minutes.

Table 14 : Operative time

Time in minutes	**Number of cases**
20-25	**09**
26-30	**10**
31-35	**05**
36-40	**01**

Mean operative time : 26.12 min

A urine culture was done in from each kidney on passage of ureteric catheter and removal of glide wire. Turbid urine was seen in 7

patients but much significance was not attached to this findings contrast was injected prior to taking a urine sample. Frank pus was seen dripping out from catheter of 2 patients. These patients had uneventful postoperative course. Since we were half the way through our procedure we went ahead and completed stenting.

Intra operative sample was positive in 6 patients. Repeat culture done was positive in 14 patients (56%).

Catheterization:

Per urethral catheterization was done in all patients and the catheter was kept in situ for 48 hrs. All patients received prophylactic antibiotic therapy on discharge.

Table 15. Complications:

Complication	Number of patients	Percentage
Perforation of ureter	**01**	**4**
Retrograde dislodgement	**01**	**4**
Haematuria (postop)	**06**	**24**
Postoperative fever	**10**	**40**
Irritative symptoms	**12**	**48**

Perforation of ureter was seen in one case. The system was drained with use of percutaneous nephrostomy. Retrograde dislodgement of stent and observed in a single case. The stent with its coil had migrated up into the lower ureter. This patient required a ureteroscopy for removal of the stent.

Table 16 : Hospital stays

Duration (days)	Number of cases
3	**4**
4	**5**
5	**11**
6	**3**
7	**2**

Mean Hospital stay: 4.76 days

Maximum patient had discharge from hospital, in 4-5 days. The mean hospital stay of patients in this study was 4.76 days

The success rate of the procedure was 89.2%. Failure rate of double pigtail stenting in the present study 10.7% stenting could not be done in 3 patients who were salvaged using a percutaneous nephtostomy.

NORMALSIATION OF CREATININE:

Normalisation of creatinine takes a varied time. Almost all patients however reached basal levels in 8 days post operatively. The mean change of creatinine was 1.2 mg% per day. One patient did not regain normal level of creatinine. On further investigations patient was

diagnosed as having medical renal disease with parenchymal dysfunction. The patient has settled with a creatinine of 2.2 mg%.

All patients were discharged on low dose antibiotic prophylaxis.

DEFINITIVE TREATMENT

FURTHER INVESTIGATIONS:

Ultrasonography provided valuable information about parenchymal thickness. DTPA renogram was done with double - pigtail stent in situ in a grossly hydronephrotic kidney to assess the perfusion. The opposite kidney if better functioning was managed definitively first. The treatment was individualized. Poor perfusion in grossly hydronephrotic kidneys was managed by removal of stent and assessment after two weeks.

Table 17 : Definitive treatment

Calculus position	Number of cases	Procedure	Performed
Ureteropelvic junction	**4**	**ESWL**	**03**
		PCNL	**01**
Upper ureter	**6**	**ESWL**	**03**
		URS	**02**
		Ureterolithotomy	**01**
Middle ureter	**13**	**URS**	**07**
		ESWL	**01**
		Ureterolithotomy	**03**
		Spontaneous passage	**02**
Lower ureter	**23**	**URS**	**21**
		Proximal migration during URS, required ESWL	**01**
		Spontaneous passage	**01**

All stents that required separate removal, were removed on OP basis under local anaesthesia. All renal units were salvaged. Follow up intra venous Urography was done in all patients at 6 weeks.

DISCUSSION

Ureteric obstruction in a solitary functioning kidney or bilateral ureteric obstruction may result in anuria. This constitutes a urological emergency, which mandates urgent drainage of the obstructed system. There is a continuing debate over the optimum method of decompression, the problem confounded by absence of clear – cut protocol for patients of calculous anuria in literature.

Proponents of percutaneous nephrostomy cite the advantages of draining of system with a large bore percutaneous nephrostomy tube and avoidance of ureteral manipulation with the potential for perforation as advantage. Further more external drainage of the kidney provides assessment of renal output and differential renal function. Advocates of stenting argue that the collecting system drainage is performed fully by the urologist in his well versed technique. The advantage of internal drainage is apparent. The compliance for internal stenting is more in India as the socio economic status and general living conditions in our country are very different from other developed countries. Maintaining of the percutaneous nephrostomy tubes for our patients is difficult and many patients have to be kept in hospital, for prolonged periods till the

definitive management is completed. Dislodgement of tube, infection and pain has been common complaints in the past.

Though then benefits of internal drainage are evident, the data on the safety, efficacy and complications of stent in calculous anuria are lacking. We have attempted to study these factors in our patients.

Age distribution of patients in this study revealed that all patients presenting between 16 years to 52 years with maximum number of patients presenting between 31 to 40 years of life with a mean age of presentation 35.64 years. This is in contradiction to a study by Jaoul in which patients presented with a mean age of 51 years. We did not encounter a single case of paediatric age group in our study.

The patients presenting with calculous anuria were predominantly males with a male to female ratio 3.2:1. There were 19 males and 6 females in this study. This is in accordance with a study of Hussain. M. who had a male to female ratio of 4.1:1.

The duration of anuria in this study group ranged from 2 days to 5 days. Majority of patients (48%) presented between 3-4 days. The mean duration of presentation was 3.2 days. This is in contradictions to CH

Leong's findings of mean duration of 2.5 days. This is due to the fact that majority of patients are referred from peripheral centers and patients had to travel long distances to travel to this centre.

Patients showed a range of creatinine of 3.8 to 18 mg%. As compared to a range in study by Hussain which had a range of creatinine from 3-35 mg%. The mean value of creatinine was 9.16 mg%.

Jaoul A recorded bilateral ureteric obstruction in 54% of patients and unilateral obstruction in 46% patients. CH Leong studied 8 patients of which 2 (25%) had bilateral obstruction, 6 (75%) had unilateral obstruction. The study group, majority of patients (84%) had bilateral ureteral obstruction. Unilateral obstruction was seen in 4 patients. Two patients with unilateral obstruction had previous nephrectomies, for calculous disease, one had a congenitally absent kidney and one patient had a grossly hydronephrotic, poorly functioning kidney.

Clinical presentation with anuria was present in all patients as this was an inclusion criterion of entry into the study group. Flank pain was the second commonest symptom.

Table 18 : Comparison of clinical presentation

Presentation	Study	CH leong
Anuria	**100%**	**100%**
Flank pain	**76%**	**100%**
Severe vomiting	**20%**	**-**
Oedema over lower limbs and face	**12%**	**-**
Respiratory symptoms Breathlessness	**4%**	**12.5%**
Headache	**4%**	**-**
Acidosis	**8%**	**12.5%**

The presentation in the present study and Leong's study are comparable except that gastrointestinal symptoms are not mentioned in this publication.

Fourteen patients (56%) had prior urological history. This compares with the finding in Leong's study in which (64.5%) of patients had history of previous renal surgery.

Approximately 90% of renal calculi are sufficiently radiopaque to be detected on abdominal radiography. In an adequately prepared bowel opaque calculi of 2-3 mm diameter can be detected by a plain radiograph. The overall sensitivity of radiograph in detecting a calculi is 90% (Thornbury JR, 1982). In presence of unprepared bowel the sensitivity would be less. In the present study plain radiograph showed a calculus clearly in 47.82% of cases. It was helpful in diagnosis of over 80% of cases. In cases of absent radiopaque density, Retrograde pyelography was helpful in demonstration of negative shadow. One of such patient taken for definitive treatment did not show any finding during Retrograde peylography, prior to ureteroscopy. In this patient we performed a Helical CT to confirm presence of stone.

All procedure were done in local anaesthesia. Ten patients (40%) required intravenous sedation in supplementation. Almost all male patients described their discomfort as moderate on the scale of mild, moderate or severe.

Operative technique compared to Margaret Pearle' study indicates that our procedure time was less. Minimum time required for a procedure was 22 minutes. Mean operative time was 26.12 min as compared to 32.7 minutes in Pearle's study group of retrograde stenting. The anaesthesia

requirement in Pearle's study was general anaesthesia and regional anaesthesia in 76% of patients. We attempted all stentings in local anaesthesia with addition of sedation by a anaesthetist, if required. None of the cases required conversion to general anaesthesia or regional anaesthesia. All patients complained of mild to moderate discomfort on postoperative questionnaire.

The stent size in all our patients was 6 Fr. Pearle used stent sizes of 7 Fr in 81% and 6 Fr in 19%.

Foley's catheter was used in Pearle study in 71.4% patients of DJ stent. We preferred to keep an indwelling catheter as it allows accurate measurement of urine output is comfortable to the patient and prevents chances of reflux.

Failure rate of double – pigtail stenting in the present study is 10.7%. This might be due to the fact that we had used hydrophilic plastic coated glide wires for access. None of the studies have mentioned the technique in detail making it difficult to conclude the reason for low failure rate of successful stent insertion in our study. However, the present study group is small as compared to the series in literature. In contrast, in two large series (Pocock, 1986 & Smedley, 1988) comprising

of 226 attempts at ureteral stent placements, stent placement was successful in 84%. Margaret S. Pearle et al has not reported any failure in their study.

Percutaneous nephrostomy was associated with a greater morbidity. Lee et al reviewed their experience of 160 patients (169 procedures). Major complications occurred in 6% including sepsis in patients not previously septic and haemorrhage requiring transfusion in 2.4% Minor complications occurred in 27.7% of patients. Yoder et al, reviewed 70 cases of pyonephrosis treated with intial nephrostomy drainage and reported complications in 28%.

Irritative symptoms and pain are common with internal ureteral stent and include flank pain in 17 to 19%, suprapubic pain in 20%, urinary frequency in 42% and haematuria in 42% (Smedley, Leong, Lingman, Graff, Audriole). Irritative symptoms were seen as commonest complication of this procedure in the present study. It was seen in 48% of patients and required pharmacological treatment. Patients settled down with medical management. The second commonest complication observed in the study was postoperative fever. It responded promptly to antibiotic therapy. Pocock et al reported perforation of ureter in 8 cases among 138 attempts at stent placement (5.8%) the incidence of ureteral

perforation has been reported to be 2-8% as reported by Leong (1989) and Graff (1988). Perforation of ureter was seen in one case (4%) in the present study. The system was drained with use of percutaneous nephrostomy. Retrograde dislodgement of stent was observed in a single case. The stent with its coil had migrated up into the lower ureter following ureteroscopic removal of calculus. These patients required a second ureteroscopy for removal of the stent. Migration of stent was reported in 9 patients by Pocock. Two of these in upward direction, one of whom required a ureteroscopy for retrieval. Stent migration occurs in 0.1 to 7% in various studies by Smedley F. (1988), Leong (1989), Lingman J. (1987) Graff (1988), and Andriole G (1984), Encrustations were rare and insignificant in the study, a result of improved stent material, good output and early removal.

Mean Hospital stay (urology ward) of patients was 4.76 days. If the patient had any associated medical problem and had to be shifted to other ward, this period was not considered. Length of stay in Pearle's study was 3.2 days in the ureteral catheterization group but higher 4.5 days in percutaneous nephrostomy group. In our set – up probably the patient would have to be kept in the ward for a much longer period of time.

The patients in whom frankly purulent urine was observed recovered well with stenting. We however do not recommend this procedure in patients of obstructive pyelonephritis or pyonephrosis.

An internal stent had further more advantages. Ureteroscopy in the presence of a stent did not require ureteric dilatation (perez castro E). ESWL in the presence of stent has a high success rate (Coptcoat MJ, 1985; Urol clinics N. America, 1990;).No statistical significant difference has been identified in the ability of ESWL to fragment stones pushed back to renal pelvis versus those that were simply by passed with a stent (Leong, 1986). Though this is not a present belief, a stent during ESWL is an advantage against the possibility of colic, reobstruction and in a solitary kidney. Pearle study also cited advantages of stent in patients requiring ESWL and ureteroscopy.

The ureterolithotomies were performed with stent in situ. This allowed easy and rapid identification of ureter. Less postoperative drainage and early discharge. The stent was removed after 2 weeks.

CONCLUSION

1. **Calculous anuria is a urological emergency requiring urgent management**
2. **Diagnosis of calculous anuria can often be made on the basis of history and clinical examination. Majority of patients have history and symptoms suggestive of calculous disease. However anuria can be the first presentation of urolithiasis.**
3. **Ultrasonography and plain radiograph KUB are excellent investigations for confirming diagnosis.**
4. **Retrograde stenting is feasible in calculous anuria.**
5. **Retrograde stenting can be done in local anaesthesia, avoding the hazards of general or regional anaesthetic in an azotemic patient.**
6. **Patients of calculous anuria have good outcome, if treated with double-pigtail stent with rapid fall of creatinine and normal renal function is achieved in this patients.**
7. **Use of double – pigtail stent has a high success rate, less complications and excellent patient compliance.**
8. **Double pigtail stent has also distinct advantage of early discharge. The stent is also helpful in definitive procedures for removal of calculi.**

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ABBREVIATIONS

1. A : Absent
2. Abn : abnormal
3. An : Anuria
4. V- Vomiting
5. Blood Inv. : Blood Investigations
6. BT : Bleeding Time
7. C / P. Clinical presentation
8. Creat Adm.: Creatinine on admission
9. CT : Clotting Time
10. D : Doubtful
11. Deft t/t : Definitive treatment
12. ESWL : Extracorporeal shock wave lithotripsy
13. Ex. Find : Examination finding
14. FP : Flank pain
15. FPU : Flank Pain Unilateral
16. FT : Flank Tenderness
17. HT : Hypertension
18. I Sym Irritative symptoms
19. LU : Lower Ureter
20. MIN : Minimum
21. MOD : Moderate
22. MU : Middle Ureter
23. N : Normal
24. Name : Abbreviated name of patient
25. Normal creat : Days required for normalization of creatinine
26. Op Time : Operation Time in minutes
27. Past Hist : Past History
28. PCNL : Percutaneous Nephrolithotomy
29. Pr Surg. Previous Surgery
30. PT : Prothrombin Time
31. RD : Retrograde dislodgement
32. S : Seen
33. Site Obst. L : Site of obstruction on left side
34. Site Obst. R : Site of obstruction on Right side
35. SOL Kid : Solitary Kidney
36. Spont pass : Spontaneous passage
37. UPJ : Ureteropelvic junction
38. Urelith Ulitho : Ureterolithotomy
39. Urethra strict : Urethral strictures
40. URS : Ureterorenoscoy
41. USG L : Ultrasonography of Kidney, Ureter & Bladder on Left side
42. USG R: Ultrasonography of Kidney, Ureter & Bladder on Right side.
43. UU : Upper Ureter
44. X – KUB L : Radiograph of Kidney, Ureter & Bladder
45. X – KUB R : Radiograph of Kidney, Ureter & Bladder on Right side.

MASTER CHART

No.	Name	Age	Sex	Anuria Duration	C/p	Past Hist	Ex. Find		Blood Inv.	Creat Adm.	X – KUB R	X – KUB L	USG R	USG L	Site R	Obst L	Op Time	Complications	Discharge	Normal creat	Def t/t	Remarks
1.	KPT	26	M	1-2	An, FP	Pr surg	FT	HT	N	3.8	S	--	MIN	---	UU	--	20	Fever Hematuria	3	3	ESWL	SOL Kid
2.	RMT	37	M	2-3	An, FPU,	Pr surg	FT	HT	N	9.2	S	D	MOD	MIN	UPJ	LU	20	Fever	3	4	ESWL URS	
3.	SMA	33	F	3-4	An, FP, ED		FT	HT	BT Abn	18	S	D	MIN	S	LU	LU	25	Fever	4	8	URS URS	
4.	LJR	45	M	3-4	An, V	Pr surg	FT	HT	N	10	---	A	---	MIN	---	LU	24	---	4	6	URS	SOL KID
5.	MA								Hyper K													Prior Dialysis
6.	PA	28	F	3-4	An, FP	Pr surg	FT		BT, CT Abn	14.5	S	A	MIN	MOD	LU	LU		RD	5	9	ESWL URS	
7.	MIR	51	M	2-3	An, FPU, ED	Pr surg	FT	HT	N	10.5	S	D	MOD	MOD	UU	UU	35	Hematuria	5	10	ESWL URS	
8.	RSP	32	M	1-2	An,V	Pr surg	FT	HT	N	8.4	S	D	MOD	MIN	UPJ	LU	27	Fever, I sym	7	4	PCNL URS	
9.	ADT	52	M	3-4	An, FP				N	14.2	S	S	MOD	MOD	UU	UU	28	Fever				
10.	LR								N									Perforation				Failure
11.	PI	31	F	1-2	An, FPU,	Pr surg	FT	HT	N	8	---	S	---	MIN	---	MU	25	Fever, I Sym	5	8	ESWL	SOL KID
12.	KS	55	F	2-3	An, V	Pr surg	FT		BT, CT, PT Abn	14	D	S	MIN	S	MU	LU	35	I sym	5	12	URS URS	
13.	BC																					Urethra strict
14.	BB	41	M	3-4	An, Br, FPU					13.5	D	S	MIN	MIN	LU	MU	22	I sym	5	7	URS URS	
15.	AR	24	M	2-3	An, V		FT	HT		7.5	S	D	MIN	MIN	MU	LU	32	1sym Hematuria	5	8	URS URS	

MASTER CHART CONTD.

No.	Name	IP No.	Sex	Anuria Duration	C/p	Past Hist	Ex. Find		Blood Inv.	Creat Adm.	X – KUB R	X – KUB L	USG R	USG L	Site R	Obst L	Op Time	Complications	Discharge	Normal creat	Def t/t	Remarks
16.	TDA	16	M	4-5	An, FP, V		FT	HT		9.7	A	S	MIN	S	MU	LU	20	Fever Hematuria	5	6	ULitho URS	
17.	DAS	39	M	3-4	An, FPU, ED					15.2	--	D	---	MIN	---	LU	38	Fever Hematuria	3		URS	SOL KID
18.	SPR	33	M	2-3	An, H		FT	HT		8	D	S	MIN	MIN	LU	MU	26	Fever Hematuria I sym	4		URS URS	
19	RPT																					Prior dialysis
20	LMA	38	M	3-4	An, FP		FT	HT	N	5.7	A	S	MIN	MIN	MU	MT	30	I sym	6	4	ESWL URS	
21	SAS	41	M	3-4	An,FP	Pr Surg	FT		N	10.8	S	S	MIN	MIN	MU	LU	22	---	4	8	URS URS	
22	VTP	48	F	3-4	An, FP	Pr Surg	FT		N	4.5	D	A	MIN	MIN	LU	MU	30	I sym	5	5	URS spont pass	
23	AJ1																					Prior dialysis
24	MLR																					Failu re
25	JR	18	M	3-4	An, FPU,		FT		N	6.2	D	S	MOD	MIN	UPJ	UU	28	I sym	5	7	ESWL URS	
26	PRS	34	M	2-3	An		FT		N	7.4	A	S	MOD	MIN	LU	LU	30	I sym	5	8	Spontpass URS	
27	MGN	44	M	4-5	An, FP	Pr Surg	FT		N	9	A	D	MIN	MIN	MU	UPJ	26	---	6	5	ESWL Urelith	
28	AKN	33	M	3-4	An, FP		FT		N	17.4	D	S	S	MOD	MT	MU	32	I sym	6	Not achieved	Uretlith URS	
29	KVA	19	M	2-3	An,FP		FT	HT	N	7.6	S	S	MIN	MIN	LU	MT	28	Fever I sym	7	8	URS URS	
30	RPR	-																				Failure
31	STI	39	M	2-3	An, FP				N	5.8	A	D	MIN	MIN	MU	LU	26		4	7	URS URS	
32	TRS	34	F	3-4	An, FP				N	4.4	A	D	MIN	MIN	MT	MU	22		3	6	URS URS	